of zero pull on the side of the axis opposite to the weights. The action of these springs is shown by the line B on the diagram. The governor balls are resting on the stops as before, and would stay there until the speed became high enough for the centrifugal force to overcome the pull of the springs in that position, when they would immediately fly out to their limit with some violence, and this action would be reversed immediately the speed fell. Such a governor would be in unstable equilibrium. The line B, as it progresses in the direction of $r_1$? cuts lines A of centrifugal force corresponding to lower and lower speeds of revolution. It is less steep than the lines A.

It is evident that a governor with either arrangement of spring or controlling force described above would be useless.

If we now arrange the springs in such a way that their zero pull on the ball is when the centres of gravity of the latter are at some distance from the axis, and their pull, represented by the line C, is steeper than the lines % and ^$_2$, representing the limits of speed between which the engine is designed to run, then the governor would be stable, for in order to stretch the spring the balls must move out radially, and this can be done only by the speed increasing and vice versa. There is thus a definite position for the balls for any given speed.

The area between that part of the line C, which intersects lines % and $n_2$, the ordinates at $r_x$ and $r_2$, and the base, is a work diagram representing the amount of energy stored in the governor through its range of action.

The effect of friction in the governor and the parts connected to it have to be considered.

If we assume this to be constant in amount and opposing motion in both directions, we may show its effect by drawing on the diagram two lines parallel to the line C, one above and the other below, at a vertical distance, which, when measured on the scale $F_c$, is equal to the frictional resistance as indicated by the two dotted lines parallel to C. We shall notice from the diagram that the line of centrifugal forces $n_2$ is in equilibrium with the upper friction line at a radius $r_b$ less than r«, and $n$± is in equilibrium

with the lower friction line at the radius $r_a$ greater than $r\pm$.

The effect is, that in order that the balls may move out to $£_2$ an-d move in to $t_{l9}$ the speed must be increased to $n_b$ and decreased to $n_a$ respectively, the total speed variation then being $n_b - n_a$ instead of $n_2 - n_\pm$. The power available is also decreased.

Fly-wheels.—The turning moment varies continuously throughout the revolution of an engine. In a single-crank engine and a double-crank engine with the cranks opposite to each other, there are two maxima and two minima positions, and in a three-crank engine with the cranks disposed at equal angles there are three maxima and minima positions. The mean effort, of course, lies between these extremes, and it is the amount of excess work generated during a maximum period, together with the defect from the mean effort during a minimum period, that causes a certain fluctuation of speed. It is the function of the fly-wheel to make this irregularity as